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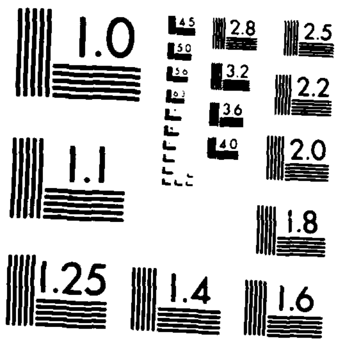

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FINAL REPORT

RESOURCE ALLOCATION IN CEREBRAL SPECIALIZATION

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ONR Final Report

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
The object of this research was to develop and test a theoretical framework of cerebral specialization in which each hemisphere is viewed as an independent information processing system. This framework is a special case of a multiple resources model of information processing in which we tie the existence and number of resource pools to the anatomical structure of the brain. We used the well specified dual task methodology of the multiple resources approach to assess the model with behavioral

measures. In addition, we employed electrophysiological measures of resource allocation to verify certain of the assumptions we made in testing the model.

In this model any given set of tasks can overlap partially, completely, or not at all in terms of the resources required from a particular hemisphere. The model makes specific predictions in each case. In our behavioral experiments, we tested the model with dual task experiments in which one task was centrally presented and was assumed to require primarily left hemisphere resources. The other task was presented to either the right or left visual field. In the first set of experiments we tested the case of complete vs. partial overlap as a function of whether a stimulus was in the right or left visual field. In the second set of behavioral experiments we tested the case of complete vs. no overlap as a function of visual field of stimulus presentation. In the electrophysiological experiment we tested our assumption that the load task we used in the dual task experiments indeed required primarily left hemisphere resources.

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This final report summarizes the work done under ONR contract number N00014-79-0679, Contract Authority Identification Number NR 150-441 for the period July 1, 1980 to January 31, 1983. All of the work discussed here has been previously published in technical reports and journal articles. The purpose of this report is to summarize the results and provide specific sources.

Research Issues

One problem of concern to the defense department has been to assess and predict the work load produced when various tasks are combined with each other in a multi-task situation. One approach to this problem has been to assume that all tasks draw upon a single limited-capacity pool of resources (e.g. Kahneman, 1973; Norman & Bobrow, 1975; Lansman & Hunt, 1981). In this approach it is assumed that two or more tasks can be performed concurrently without degradation of performance until the demand for resources exceeds the resource capacity, then performance on one or all of the tasks will begin to degrade. Within this approach, if the resource demands are equal, the type of tasks which are combined are irrelevant to predicting task interference patterns and workload. Only the total amount of resources demanded determines task interference patterns and workload.

An alternative approach has been to assume that there exists a number of different types of limited-capacity resource pools (Navon & Gopher, 1979; Wichens, 1980). The types of resources a task requires is referred to as its resource composition. A given set of tasks may overlap completely, partially, or not all in their resource compositions. Obviously, within this framework, it is the overlap in resource composition and not the overall amount of resources required, which will determine the extent to which one task will interfere with the performance of another. However, within the more general multiple resources approach, it's difficult to *a priori* specify the resource composition of a given task. Therefore, there is no way to predict the interference patterns between two tasks.

In this project we have developed a special case of a multiple resources approach in which each hemisphere is viewed as an independent information processing system with a limited-capacity pool of resources. Within this approach we can draw upon over a hundred years of research in cerebral specialization to *a priori* specify the resource composition with respect to the two hemispheres of a given task.

Theory Development

The first objective of this research was to develop a framework from which to understand cerebral specialization of function from the standpoint of a more general human information processing approach. The historical antecedents of our approach were developed by Kahneman (1973) and Norman & Bobrow (1975), and others, in the context of an information processing model that views the organism as having a single, undifferentiated pool of finite resources. This single capacity model has been extended by Navon & Gopher (1979) to allow for the likelihood that there are multiple pools of resources. We adopted a subset of the multiple resources approach and viewed the hemispheres as having mutually inaccessible supplies of resources. This theoretical framework is presented in detail in ONR Technical Report No. 1 and Friedman & Polson (1981).

To show how a multiple resources approach framework is both theoretically and methodologically relevant to the field of cerebral specialization, it is necessary to first briefly review some of the current models of the mechanisms responsible for hemispheric differences. The oldest and most popular approach to cerebral specialization involves the use of a primarily descriptive framework based on the idea of direct access. This viewpoint assumes that the two sides of the brain are differentially efficient for processing certain types of information, and that the behavioral differences observed when stimuli are laterally presented, such as with dichotic listening and visual half field presentations, result from the fact that these task environments allow one or the other hemispheres to have more direct access to the most efficient hemisphere. A variation of this model is the callosal transfer model. This model says that each hemisphere is specialized for processing certain information and if stimuli arrive at the wrong hemisphere, the representation must be transferred across tha callosum to the other hemisphere. These approaches, however, have difficulty in accounting for individual differences in degree of lateralization and the ability of subtle stimulus, instructional, and other manipulations to readily change performance advantages from one hemisphere to another.

In contrast to a direct access approach, Kinsbourne and his colleagues (Kinsbourne, 1970, 1973, 1975) have proposed a selective activation hypothesis in which they assume that the involvement of a hemisphere in a task creates a gradient of attention such that maximum attention is directed to the part of the sensory space most contralateral to the involved or "activated" hemisphere. Therefore, any stimulus with direct access to the more activated hemisphere should be processed more efficiently than a comparable stimulus presented ipsilaterally, regardless of whether that hemisphere is "normally" good at process information of that type.

A number of dual-task experiments have been performed in an effort to test the selective activation hypothesis, but have provided little parsimonious support for the theory (Hellige & Cox, 1976; Hellige, Cox, & Litvak, 1979). In attempting to understand cerebral specialization of function, there have been few efforts to use the theoretical machinery developed within the domain of cognitive psychology to account for data from the cerebral specialization literature that are extremely germane to more general issues of human information processing. In developing our theoretical approach, we used the theoretical machinery developed in the divided attention literature to give a more comprehensive framework for cerebral specialization. In addition we used the data from the cerebral specialization literature, particularly those tasks which have used dual task methodology, to account for results from the field of divided attention,

The historical antecedents of our approach were developed by Kahneman (1973) Norman & Bobrow (1975), and others, in the context of an information processing model that views the organism as having a single, undifferentiated pool of resources. This single capacity model was elaborated by Navon & Gopher (1979) to allow for the likelihood that there are multiple pools of resources. We adopted a subset of that approach in that we view the cerebral hemispheres as mutually inaccessible pools of resources.

We will first describe the assumptions of a single capacity model since most of these apply to each pool of resource in a multiple resources approach. The first assumption is that the supplies in any system are limited, and that

all mental processes must compete for resources from the same common pool. Implicit here is the idea that processes can occur in parallel without observed performance decrements, so long as the demand for supplies does not exceed the capacity. Within this framework, the results produced by a particular mental process depend on both the nature of the data it receives and on the amount of resources that have been allocated to it.

These curves which depict the relationship between resource allocation and performance are called Performance-Resource Functions, and as Navon and Gopher point out, they describe a legitimate relationship only if all other factors were held constant when they were derived. These factors are called Subject-task parameters, and they include such things as task difficulty, response complexity, visual field of presentation, exposure duration, stimulus type and quality, level of practice, visual acuity, sex, handedness, and so on.

If allocating additional units of resources affect performance then performance is said to be resource-limited, and the resource performance function monotonically increases. If additional units of resources does not affect performance then performance is said to be data-limited and the resource-performance function is horizontally. The performance on a task depends on both the amount of resources allocated to it and their relative efficiency, where efficiency is the amount of improvement in performance per unit of resource added, and is reflected in the slope of the function at any given point. The formulation just outlined implies that processes drawing from the same pool of supplies won't interfere with each other until the total amount of resources they need exceeds the capacity and at least one of the tasks is resource-limited. According to a single-capacity model, this idea can be tested by requiring that two or more tasks be performed concurrently, and observing performance changes as resources are differentially allocated between them. The joint performance function for two tasks is called a Performance Operating Characteristic, or POC curve.

Navon and Gopher (1979) pointed out several assumptions implicit in using a POC curve to test a single-capacity interference model, questioned the viability of these assumptions, and proposed a multiple-resources model as a more reasonable alternative. The single-capacity assumption we think is least likely to be viable in a complex information processing environment is the assumption that when two or more tasks are combined, an increase in resources applied to one task will necessarily result in an equal decrease in resources available to the other task. This assumption implies that the resources used by the two tasks together equals the capacity and is called Complementarity of Supplies.

Based on evidence from a number of experiments from the cerebral specialization and divided-attention literatures, and we proposed that the data from these experiments can be most parsimoniously understood from the viewpoint that there are basically two types of resources--those deriving from the left and right hemisphere, which have mutually inaccessible resource supplies, so that complementarity of supplies can not hold. This is the simplest case of a multiple resources approach.

The basic idea of the multiple-resources alternative is that resources may be of a number of different types, each with its own limited capacity. The particular types demanded by a task will be a function of subject-task parameters and is referred to as its Resource Composition. If each hemisphere acts as an independent supply of resources, then two tasks can overlap

completely, partially, or not all in their resource composition. Navon & Gopher (1979) describe the methodology for showing that two tasks share a common resource (i.e. overlap in their resource compositions). In general it involves obtaining single and dual-task performance on each task. In the dual-task situation the amount of resources allocated to each task is systematically varied by means of pay-off ratios or task emphasis instruction across several levels. In order to show that two tasks share a common resource it is necessary not only to show performance decrements of a single task when it is combined with a second task, but also that performance trade-offs occur, i.e., as performance on one task worsens, performance in the other task improves.

If the resource composition of two tasks overlap completely, then both single to dual task decrements and performance trade-offs should be observed. If there is no overlap in resource composition of two tasks, performance trade-offs should not be observed. In some cases, however, single to dual task decrements still may be present. (See Navon & Gopher, 1979; Friedman & Polson, 1981; for a discussion of this issue). In case of partial overlap, decrements and trade-offs will also be observed, but the pattern will depend on the amount of and type of overlap.

ONR Contract Technical Report No. 1

Resource Allocation in Cerebral Specialization

Alinda Friedman and Martha Polson

Abstract

In this paper, we develop a broad and cohesive theoretical framework from which to understand how cerebral specialization of function contributes to the adaptivity and flexibility of the human information processing system. In particular, we propose that the anatomical division of the brain can be mapped onto a division of processing resources so that the left and right hemispheres together comprise a system in which there are two pools of mutually inaccessible, finite, resources. Further, these two types of resources cannot be made available in different amounts for a normal individual whose callosum is intact. Thus, the framework we propose is essentially a special case of a multiple-resources model of limited-capacity information processing (Navon & Gopher, 1979), in which we tie the existence and number of resource pools to the anatomical structure of the brain. Our theoretical structure allows us to account for a broad range of data from both the divided attention and cerebral specialization literatures, including experiments involving perceptual and cognitive information processing, control of motor performance, and changes in the electrical activity of the brain. The framework also provides insights into specific mechanisms that could account for why the cerebral specialization literature has been plagued with the sort of problems that have made theorizing in this domain difficult, such as the ease with which stimulus, instructional, and other task manipulations can change performance advantages from one to the other visual field, ear or hand; the difficulty of replicating data across laboratories and paradigms; and the wide range of within- and between-subjects individual differences usually observed on indices of cerebral specialization. In addition, the theory provides insights into mechanisms that might be responsible for patterns of task interference observed in the divided attention literature that are not easily accounted for by a limited-capacity model in which there is only a single pool of undifferentiated resources. Thus, the framework we are proposing has important theoretical and methodological implications for researchers in both the divided attention and cerebral specialization domains, and demonstrates the mutual need for these investigators to be aware of each other's work.

Experimental Tests of the Theory using Behavioral Measures

In order to test the assumption that each hemisphere acts as an independent resource pool, tasks were selected for which the resource composition with respect to the two hemispheres could be specified a priori based on the cerebral specialization literature. Subjects were carefully screened for lateralization on these tasks so that the resource composition would be the same for all subjects. One task was a centrally presented load task designed to demand primarily left hemisphere resources. The other task was laterally presented. In the laterally presented task the resource composition with respect to the two hemispheres could be expected to vary as a function of whether the stimulus was presented to the left or right visual field (LVF and RVF).

In one experiment (ONR Technical Report No. 2; Friedman, Polson, Dafoe, & Gaskill, 1982) two tasks were chosen which were expected to show complete or partial overlap depending upon the visual field of presentation. In the other experiment, (ONR Technical Report No. 3; Friedman, Polson, Dafoe, & Gaskill, 1982) complete or no overlap was predicted as a function of visual field of presentation. For comparability, the same verbal memory load task was used in both experiments. In single-task conditions of this experiment subjects saw either 2, 3, or 4 nonsense words (CVCVCs), read them aloud, held them in memory, and then tried to recall them. In the second experiment only the 3-word memory load was used. Due to our screening procedure, we could say with some assurance that this task demanded primarily left hemisphere resources from our particular subjects, and more so with increasing memory loads.

In the first experiment, the target task involved naming nonsense words (CVCs) that were briefly presented to either visual field. This task has two major processing components: perceptually decoding the words into some form of phonemic representation, and speaking the response. Although both hemispheres should be capable of perceptually decoding verbal information, verbal production is one of the few task components that may demand a specifically left hemisphere resource for right-handed people (see Sperry, 1974; Wada, Clark, & Hamm, 1975). Thus, when the CVC was presented to the RVF for naming, both components of the naming task, as well as whatever processes were involved in the memory task all demanded exclusively left hemisphere resources, making this a complete overlap situation. In contrast, when the CVC was presented to the LVF, although left hemisphere resources were still required for verbal output of the CVC and any processes involved in the memory task, right hemisphere resources could be used to perceptually decode the naming task stimulus. On RVF dual-task trials, left hemisphere resources were predicted to be more scarce than on LVF trials, and more so with increasing memory loads. And in fact, subjects who maintained consistent RVF single-task performance advantages for naming nonsense words (over several days of testing) showed larger decrements from single-task performance on RVF trials than on LVF trials in the dual-task situation, such that both naming task and memory performance was now superior when the stimuli to be named were presented to the LVF. In addition, the payoff manipulation produced reliable performance tradeoffs on both types of visual field trials, thus providing the necessary evidence for some overlap in left hemisphere demand in both cases.

In the second study, we checked the possibility that the results of the first experiment could have been due to output interference between tasks, since both the memory and naming tasks required a spoken response. We also investigated the important question of whether the resource supplies of the two

hemispheres are independent. The target task was one in which pairs of nonsense syllables (CVCs) were presented to either visual field, and subjects performed physical or name identity judgments. Since the response for this was bimanual, we could eliminate output interference between tasks as a factor contributing to the performance decrements. More importantly, since the identity judgments did not require a spoken response, we assumed that the processes necessary to perform would be similar to the perceptual decoding aspects of the naming task, and thus could presumably be performed in their entirety by each hemisphere. When the same-different task stimuli were presented to the RVF-LH, we predicted complete resource overlap, because left hemisphere resources were demanded by both tasks. When the target task stimuli were presented to the right hemisphere, we predicted no overlap in resource demand--left hemisphere resources could be used for the verbal memory task, while right hemisphere resources could be used for the same-different task.

Decrements from the single-task performance of both tasks were more severe when the target task stimuli were presented to the RVF rather than to the LVF. Indeed, there were virtually no decrements from single-task performance on LVF trials. Subjects could only trade performance between tasks on RVF trials, indicating that left hemisphere resources were in demand for both tasks on these trials. On LVF trials, there were no performance tradeoffs between tasks as a function of shifting emphasis, indicating that this was indeed a case of no overlap in demand, and providing the first support for our contention that the supplies of each hemisphere are independent.

ONR Technical Report No. 2

Competition for Left Hemisphere Resources: Right Hemisphere Superiority at Abstract Verbal Information Processing

Martha C. Polson, Alinda Friedman, and Sarah J. Gaskill

Abstract

In this paper we present a direct test of a multiple-resources appro h to resource allocation in information processing, in which the two c ral hemispheres are assumed to have separate, limited-capacity po of undifferentiated resources. Five right-handed men were selected on the b of having manifested a RVF-LH superiority for processing the stimuli used i each of two tasks that were to be performed concurrently in the main experim . We then measured both single and dual-task performance on the tasks, which a centrally-presented verbal memory load, and a nonsense syllable naming task in which the syllables were presented to either visual field. Subjects were paid according to their accuracy during both single and dual-task trials; on the latter, the payoff ratios were varied, to induce them to allocate more attention to either the memory task, the visual field naming task, or to both equally. In our approach, the two types of visual field trials are treated as two different dual-task situations. Right and left visual field trials of the naming task combined with the verbal memory load constitute, respectively, cases of complete or partial overlap in demand for the left hemisphere resources. Therefore, on RVF dual-task trials, left hemisphere resources should be more scarce than on LVF trials. Under moderate to heavy memory loads, subjects who had shown large RVF single-task performance advantages for naming nonsense words showed larger performance decrements on RVF trials than on LVF trials in the dual-task situation, such that both naming task and memory performance was now superior when the naming task stimuli were presented to the left visual field. In addition, the payoff manipulation produced a reliable Task X Task Emphasis interaction, indicating that performance tradeoffs between tasks were occurring on both types of visual field trials, and thus providing the necessary evidence for overlap in demand. The experiment is illustrative of the prescribed methodology for testing models of limited-capacity processing, and the data support the idea that there are at least two types of resource supplies, which are associated with processing in the left and right hemispheres. ability to process different types of spatial frequency information.

ONR Technical Report No. 3

Cerebral Economics: Resource Competition Within But Not Between Hemispheres

Alinda Friedman, Martha Campbell Polson, and Cameron G. Dafoe

Abstract

In this paper, we test a model in which it is assumed that the left and right cerebral hemispheres have access to independent supplies of resources, which they may each use in most kinds of information processing situations. Eight male subjects were specifically selected for having demonstrated a strong right-hand superiority on several manual tasks, and a strong RVF-LH superiority for processing the stimuli we would be using as a verbal memory load in a dual-task situation. Their performance was then measured on the memory load task, on a target task in which pairs of stimuli were presented to either visual field and subjects performed physical or name identity judgments, and in a situation in which both tasks were combined. In our approach, right and left visual field trials of the target task combined with the verbal memory load are treated as two different dual-task situations, comprising cases of complete vs. no overlap in demand for left hemisphere resources, respectively. Subjects were paid for both single and dual-task performance; in the latter case, the payoff ratios rewarded them more for either their memory or target task accuracy. Decrements from single-task performance were less severe on both tasks when subjects were performing physical rather than name matches, and importantly, when the target stimuli were presented to the LVF rather than the RVF. Further, subjects were able to trade performance between tasks on RVF trials, indicating that left hemisphere resources were demanded and being used for both tasks on these trials. However, on LVF trials, there were no performance tradeoffs between tasks as a function of shifting emphasis, indicating that this was indeed a case of no overlap in demand. The data support the idea that the resource supplies of the left and right hemispheres are independent, and have implications for both cerebral specialization and divided attention issues.

Electrophysiological Tests of Theoretical Assumptions

Our multiple resources approach to cerebral specialization of function has been supported by behavioral studies using a dual task paradigm. An assumption, critical to the testing of our theoretical position is that the load task employed in these studies uses more resources of the left hemisphere than the right hemisphere in right handed individuals. In the dual task situation, the load task occurs in conjunction with stimuli presented either to the right or left visual field. The resource requirements or resource composition of the laterally presented tasks were inferred on the basis of behavioral performance measures on the two tasks. With behavioral techniques, however, it is not possible to independently evaluate the assumptions concerning the load task.

The purpose of the present study was to assess using electrophysiological methods the assumption that the load task required primarily left hemisphere resources. Specifically a probe technique was selected which has proven to be sensitive to differential activity of homologous areas of the cerebral cortex during the performance of various tasks (D.W. Shucard, J.L. Shucard, and D.G. Thomas, 1977; D.W. Shucard, K.R. Cummins, D.G. Thomas, and J.L. Shucard, 1981). The paradigm used consisted of the presentation of a visual fixation point followed 4 seconds later by a slide containing either 2 3 CVCVC nonsense words selected from those used for load stimuli in the behavioral studies. The subjects read the CVCVCs aloud. Four seconds following the offset of the load slide, the "respond" slide appeared and subjects had to recall the load stimuli aloud from memory. Subjects were instructed to mentally rehearse the stimuli during the delay period. Accuracy in recall was scored and the subjects were given feedback about their performance on each trial. As probes of cortical functioning, two sets of tone pairs were presented to the subjects over headphones. One set was presented during the interval between fixation point onset and load onset (Preload Phase); the other set was presented during the interval between load offset and the subject's response (Load Phase).

Auditory evoked activity was recorded for each tone of the tone pairs. Based on data obtained in our laboratory from a number of different studies, these tones allow us to examine patterns of neuronal activity as a function of information processing (Shucard, Shucard, & Thomas, 1977; Shucard, Cummins, Thomas, & Shucard, 1981). During the course of an experiment, four auditory evoked potentials (AEPs) were obtained - one for each of the tone stimuli in each pair of tones. In this experiment the recordings were obtained from homologous areas of the right and left temporal lobe (T_4 and T_3, respectively) referenced to a mid-parietal electrode (P_z). These electrode placements are of theoretical significance in that they overlie visual association and auditory processing areas of the brain. Forty to fifty trials provided us with reliable data for each subject.

It is important to note that the AEP data are obtained <u>only</u> when the fixation point is on the screen either prior to the appearance of the load stimuli of after the load stimuli have been presented during the time that the subject is mentally rehearsing the load and preparing to respond. Thus, no <u>visual</u> information processing is required while AEPs are being measured; the subject is either preparing to receive the stimuli or silently rehearsing them. Information about the brain's response to the tone probes is obtained under two conditions: (1) Prior to the onset of the load stimuli (Prepared Phase) and (2) during mental rehearsal of the load stimuli (Load Phase).

Single trials were summed off-line. Based on the EEG paper record, any trials containing artifact related to body movement, eye movements, etc. were eliminated. AEP peaks were identified for each average and confirmed independently by two investigators using a cursor on an AED 512 video graphics system linked to a PDP 11/34 computer. Amplitude and latency measures were compared and discrepancies were resolved by a third investigator. The measures that were obtained for each AEP peak were as follows: Latency in milliseconds of four peaks: P_1, N_1, P_2, N_2: absolute amplitude of each of these four peaks from baseline (isoelectric zero), and peak to peak amplitude measures for $P_1-N_1, N_1-P_2, P_2-N_2$. For each subject 16 AEPs were obtained: Tone 1 and Tone 2 for right and left hemisphere recordings for Preload and Load Phases for each load level (2 or 3 CVCVCs). A total of 34 subjects were studied (17 males and 17 females). Load level was randomized throughout the experiment. The peak latencies and standard deviations collapsed across all conditions, tones, hemispheres, sexes and load levels were as follows: P_1 (X=51.4 msec, SD=12.7); N_1 (X=92.0 msec, SD=6.2); P_2 (X=149.9, SD=10.4); N_2 (X=217.5, SD=17.4).

The findings of most significance were as follows: (1) The rate of fast habituation (AEP amplitude decrement between Tone 1 and Tone 2) differed between right and left hemisphere recordings. Consistent with our hypothesis, the right hemisphere AEPs showed a greater Tone 1-Tone 2 decrement than the left during the Load Phase. (2) This effect was not seen during the Preload Phase and was enhanced for the 3 load as compared to the 2 load condition. (3) This relationship between load level and AEP fast habituation was seen for 7 of 9 male subjects but only for 5 of 11 females. (4) The effect was best observed for Peak 2 (N_1-P_2), a positive-going peak with a latency of 92 to 150 msec.

The data obtained and described above are consistent with our expectations. It was hypothesized that those brain sites most involved in the processing of the information presented would show less fast habituation as compared to those areas not as involved in the task. That is, if performance of the load task required primarily left hemisphere resources, there should be fewer resources left over to respond to the task-irrelevant tone pairs. Degree of fast habituation or percentage of AEP amplitude decrement from Tone 1 to Tone 2, according to our framework, is positively related to the amount of resources available - that is the greater the degree of fast habituation the more resources are available to respond to incoming stimuli. Put another way, the less the degree of fast habituation to the irrelevant tone stimuli, the fewer the available resources, since that brain site is more engaged in the processing of the ongoing stimuli than, for example, another brain site and therefore is less responsive to the task irrelevant tones. With the electrode configuration used, this effect would manifest itself as a higher amplitude response from the more activated site.

Our findings also indicate sex differences in the allocation of resources for the load tasks studied. Females did not show the asymmetry of responding that males did. This is consistent with the view that adult females are less lateralized than males, and suggests that the sexes may process information differently. Further studies are needed to clarify these results related to sex. In summary, the results reported herein offer further evidence to support the hypothesis that the CVCVC task is a task (which at least for males) utilizes left hemisphere resources to a greater degree than it utilizes the resources of the homologous areas right hemisphere.

ONR Technical Report Number 4

Electrophysiological Indices of the Allocation of Cerebral Resources

Shucard, D.W., Salamy, J.G., Hill, J.C., Gay, E.C., and Polson, M.C.

Abstract

Auditory evoked potentials (AEPs) were obtained to pairs of task-irrelevant tone stimuli while subjects memorized and recalled visually presented CVCVCs (nonsense words). It was hypothesized that AEPs recorded from right and left temporal regions of the brain would provide physiological measures of the allocation of cerebral resources involved in the performance of the task. The findings supported the hypothesis in that for the majority of males tested (7 of 9) the AEP index of hemispheric task involvement indicated greater left hemisphere involvement in the task; whereas similar effects were obtained for only approximately half of the females tested (5 of 11). This effect was enhanced as load level increased. The findings are consistent with the results of behavioral dual task studies that have shown that the CVCVC task differentially engaged relatively more left than right hemisphere resources. Our findings also suggest that gender plays an important role in the organization and utilization of cerebral resources.

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